



Tanta University

Electrical Power and Machines Depart. Power System Protection Fourth Year- First Term 2016-2017



Faculty of Engineering

Sheet (1)

1. For the system in Figure 1, the fault at **F** produces these differing responses at various times

- R_1B_1 and R_2B_2 operate.
- R_1B_1 , R_2 , R_3B_3 , and R_4B_4 operate.
- R_1B_1 , R_2B_2 , and R_5B_5 operate.
- R_1B_1 , R_5B_5 , and R_6B_6 operate.

Analyze each of these responses for fault **F** and discuss the possible sequence of events that have led to these operations. Classify each response as being correct, incorrect, appropriate, or inappropriate. Note that 'correct-incorrect' classification refers to relay operation, whereas 'appropriate-in appropriate' classification refers to the desirability of that particular response from the point of view of the power system. Also determine whether there was a loss of dependability or a loss of security in each of these cases.

2. In the system shown in Figure 2.a and 2.b, it is desired to achieve overlap between the zones of protection for the bus and the transmission line. Show how this may be achieved through the connection of CTs to appropriate protection systems.

3. In the part of the network shown in Figure 3, the minimum and the maximum operating times for each relay are 0.6 and 2.0 cycles (of the fundamental power system frequency), and each circuit breaker has the minimum and the maximum operating times of 2.0 and 6.0 cycles. Assume that a safety margin of 3 cycles between any primary protection and back-up protection is desirable. P_2 is the local backup for P_1 , and P_3 is the remote backup. Draw a timing diagram to indicate the various times at which the associated relays and breakers must operate to provide a secure (coordinated) backup coverage for fault **F**.

4. For the system shown in Figure 4, the following circuit breaker are known to operate. Assuming that all primary protection has worked correctly, where is the fault located in each of these cases?

- B_1 and B_3
- B_3 , B_4 , B_1 , B_5 , and B_7
- B_7 and B_8
- B_1 , B_3 , B_5 and B_7 .

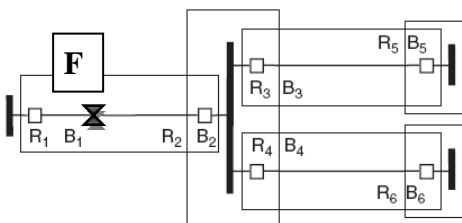


Fig. 1

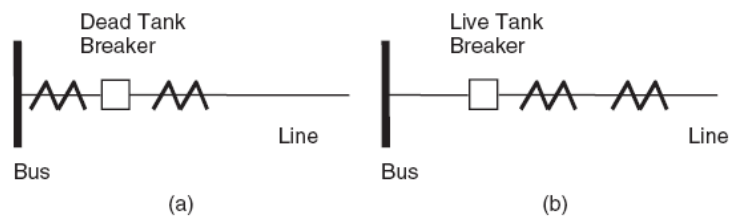


Fig. 2

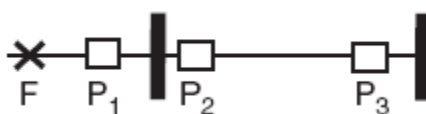


Fig. 3

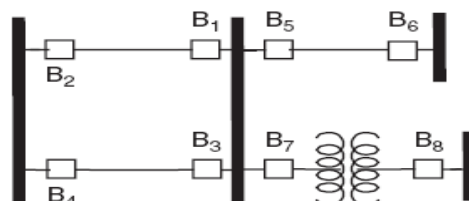


Fig. 4



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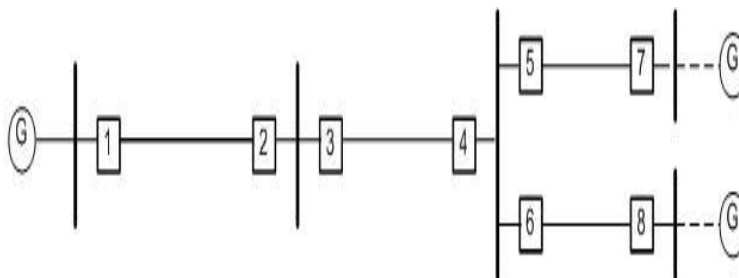
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5. The portion of a power system shown by the one-line diagram of the following figure, with generating sources back of all three ends, has conventional primary and backup relaying. In each of the listed cases, a short circuit has occurred and certain CBs have tripped as stated. Assume that the tripping of these breakers was correct under the circumstances. Where was the short circuit? Was there any failure of the protective relaying, including breakers, and if so, what failed? Draw a sketch showing the overlapping of primary protective zones and the exact locations of the various faults.

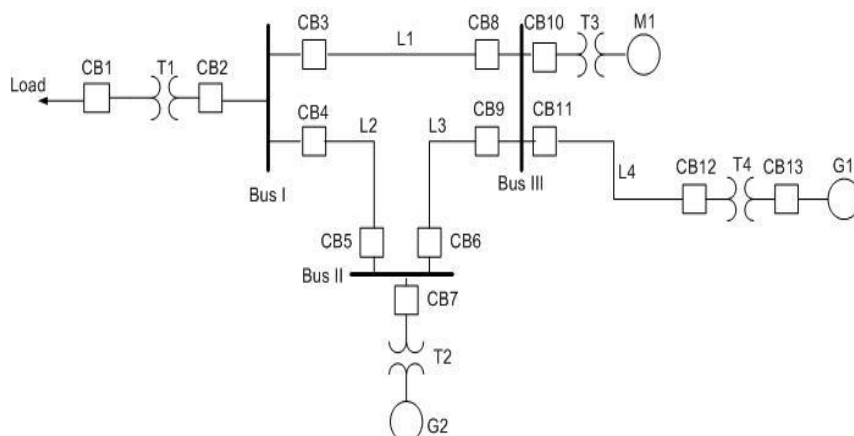
Case	Breakers tripped
A	4, 5, 8
B	3, 7, 8
C	3, 4, 5, 6
D	1, 4, 5, 6
E	4, 5, 7, 8
F	4, 5, 6



6.

- Circle the zones of protection for the following power system?
- State which CBS trip for a fault at :

- L₁
- Bus II
- Bus III
- G₂
- T₄
- Load
- M₁



- For a fault on Bus I and CB₃ fails which CB operate as backup.
- Does CB₂ need to operate for a Bus I fault?
- For a fault on L₄ which CBs backup CB₁₁?
- For a fault on L₂ which CBs backup CB₄?
- CB₆ and CB₉ trip, where was the fault?
- CB₆, CB₉, CB₈, CB₁₀, and CB₁₁ trip, where was the fault?
- CB₂ trips, where was the fault?
- CB₁ trips, where was the fault?
- CB₇ trips, where was the fault?
- For a fault on Bus III, which CBs:
 - Trip first.
 - If the ones which should trip first don't. Which ones should trip next?